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By

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COOPERATIVE RESEARCH AND SERVICE DIVISION

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By
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The present trend toward large-scale dairy plants is one of the most important economic developments that has occurred in the history of the dairy industry in the United States. Research directed toward analyzing the trend thus far has been limited, however.

This report is an attempt to present a relatively comprehensive picture of the development and characteristics of this trend, and to emphasize the urgent need for reorganizing and consolidating many existing cooperative dairy associations.

Much of the data presented herein pertains to the dairy industry as a whole and not solely to cooperative associations. The trend is industry-wide and must be considered from that standpoint. If a cooperative dairy association is to view in proper perspective its own particular competitive situation, it cannot ordinarily differentiate between its competitors on the basis of the type of proprietorship under which they individually operate.

SIGNIFICANCE OF THE TREND TOWARD LARGE-SCALE PLANTS

In general, the dairy plants offering the greatest opportunities for success are those in which all the milk solids may be used profitably. Such use of milk is not ordinarily possible in small plants. It is not necessarily effected in large-scale plants, but with relatively minor changes these plants can be adapted to permit such utilization.

No attempt is made herein to establish a definite line of demarcation between those plants which are large-scale and those which are not. "Large-scale" is a purely relative term and the line would not be fixed but might change from year to year. The advantages of large-scale operations, however, may be as important 20 years from now as at present.

The term "large-scale" denotes merely large productive capacity. The terms "diversified" and "flexible" denote an adaptability of productive capacities that cannot be profitably attained in a small plant. Although it is impossible to accurately forecast all future competitive conditions,

Note: This report supersedes FCA Miscellaneous Report 80, by the same author, issued in March, 1945. In preparing M.R. 80, constructive suggestions were received from D. D. Brubaker, Principal Agricultural Economist, Farm Credit Administration, and W. P. Mortenson, H. C. Trelogan, and D. S. Anderson, all then employed by the War Food Administration. Credit also is due Rushia K. Owens, Agricultural Statistican, Farm Credit Administration, for assembling the data needed to bring up-to-date most of the tables and charts presented in this report.

it may be assumed that, under certain conditions at least, a "large-scale" plant that is reasonably "diversified" will be competitively stronger than a "large-scale" plant that is not "diversified."

The relative merits of diversified and specialized plants of approximately equal size have not been finally determined. Perhaps they should be judged on an individual case basis. The price advantages of the diversified plant must, in any event, be weighed against the greater opportunities for operating economy in the specialized plant.

If the number of diversified plants increases, competition will probably also increase. Such plants have the ability to shift their productive capacities rather quickly from manufacturing one dairy product to that of another. This may tend to prevent the price of any one product from getting seriously out of line with the prices of other dairy products. It might have a beneficial, stabilizing effect on the industry as a whole but would mean that some high-cost, small-scale plants would be eliminated.

From the data subsequently presented as evidence of the existence of the trend toward large-scale plants, it is impossible to differentiate between those plants which are diversified and those which are not. Diversification of operations must be considered as a refinement of the trend toward large-scale plants, rather than as a separate development.

In addition to increasing efficiency in utilizing milk solids and the opportunity to achieve greater diversification of operations, there are certain other factors which favor large-scale plants compared with small-scale plants. The latter factors are principally concerned with operating economies related to size, and the processing and marketing advantages that may be secured by an organization operating a large-scale plant. They are discussed in some detail in a subsequent section of this report.

Groups of local associations, by pooling their marketing and purchasing activities, can effect substantial savings for the individual associations. The pooling plan merits recognition as a substantial improvement over prevailing practices and may provide the solution to the problems of associations in some areas. In general, however, it appears to be no more than an evolutionary step toward the greater economies that can be effected through consolidation.

Cooperating farmers should realize that eliminating the least efficient plants is a major problem in most localities in the important dairy production areas. They should realize also that (1) the change can usually be effected much more cheaply and on a more economically sound basis if it occurs as a result of rationalized action rather than purely competitive processes, and (2) the change will occur whether or not cooperative associations are the ones to take the initiative in meeting modern conditions in the industry. In order to improve or even maintain their present status in the industry, cooperatives must plan now to meet this challenge. If, compared with non-cooperative organizations, cooperatives are not of equal or superior service to farmers and consumers, they cannot, and should not, continue to operate.

VARIABLE FACTORS AFFECTING A STUDY OF THE TREND

The single factor, probably creating the most difficulty in ascertaining the full measure of the trend toward large-scale dairy plants, is that pertaining to changes in the average percentage of capacity at which the plants are operated. This is particularly important when changes in the annual average production per plant are considered. Prior to World War II, a majority of the dairy plants in the United States probably were operated at levels well below their maximum capacity.

Data relative to the percentage of capacity at which large numbers of individual dairy plants operate are not available. Plants can be classified as large-scale, therefore, only on the basis of what they actually produced and not what they might have produced had they been operated as near capacity as seasonal fluctuation of milk receipts would permit. Furthermore, classification of a plant as "large-scale" solely on the basis of large capacity could be misleading. A plant with large capacity but small production would lack not only the advantages of large-scale operations, but would also probably be less efficient than a smaller plant (with approximately equal production) operated nearer capacity.

It is not reasonable to assume that the entire increase during recent years in average production per dairy plant is attributable to changes in the percentage of capacity at which the plants have operated. For example, average production per plant making whole milk Amercian cheese in the United States was approximately 3.3 times as large in May 1949 as in June 1932. These were the peak production months.

If we assume all plants to have operated at 100 percent of capacity in May 1949, they would, if no other changes had occurred, have been operated at only 30 percent of capacity during the peak month of 1932. This seems hardly possible. A business with as great a seasonal variation in production as the cheese industry could hardly be expected to maintain several thousand organizations if production during the peak month were at such an inefficient level.

There are at least a dozen other factors, in addition to changes in the percentage of capacity at which the plants are operated, which cannot be accounted for except by applying complex statistical techniques. In this report, however, an attempt is made to describe only general relationships. Its principal objective is to stimulate vitally necessary action on the cooperative front, rather than to present a scientific analysis of a challenging statistical problem.

The data given on succeeding pages should not be interpreted as reflecting only the trend toward large-scale plants. However, a portion of the increase in average size of each of the various types of dairy plants is attributable to that trend. No attempt is made herein to determine the relative importance of the portion but it is believed large enough to be significant.

MEASUREMENT OF THE TREND[1]

Measuring the trend toward large-scale dairy plants contributes to an understanding of its historical development and its present economic significance. However, members of individual cooperative dairy associations should not place too much emphasis on comparing the size of their plants with the State or national averages. Each association should be most interested in the sizes of the dairy plants in its own competitive area. It must be remembered, furthermore, that competition will come from dairy plants of all types and not only from those making the kinds of products manufactured in the association's own plant.

The trend toward large-scale plants may be measured in a number of different ways. These may relate to changes in physical make-up of existing plants, relative size of newely constructed plants compared with previously existing plants, number of employees, number of producer-patrons, or average volume of business. Data are not available to permit measurement by most of these methods.

The problem is approached in this report by considering average volume of business. Comparisons of and changes in annual average production and in receipts are discussed in this section. Comparisons of the total value of annual sales are not satisfactory because of the variable factors which may distort the entire picture. Market price fluctuations, quality and location price differentials, and changes in sales outlets and marketing costs may affect the validity of conclusions derived from such comparisons.

The following data pertain to all dairy establishments which make the given products, and not to specialized plants only. The average size of the specialized plants would probably be considerably greater than that of all plants manufacturing a given product. In addition, it must be remembered that the data reflect changes in a number of variable factors, including the average percentages of total capacity at which the plants were operated.

COMBINED PRODUCTION OF COOPERATIVE AND NON-COOPERATIVE PLANTS
Annual Average Production Per Plant

Annual average production per plant has increased remarkably during the last 35 years in the dairy plants in the United States producing the principal dairy products. Data relative to changes in size of milk distributing plants are not available, but the trends toward large-scale plants in the butter, American-cheese, dried skim milk, evaporated milk and ice cream branches of the dairy industry are discussed in this section of the report.

[1]The data presented in this section of the report were, unless specifically noted otherwise, either taken directly from or based on compilations of the Bureau of Agricultural Economics, U. S. Department of Agriculture. Butter: Data for the years before 1931 are for creamery butter alone; from 1931 through 1949 the data include the number and production of plants producing whey butter. American cheese: The data pertain to the production of whole milk cheese only, and not to that made from part-skim or full-skim milk. Dried skim milk: Data represent production of both human food and animal feed unless specifically noted otherwise. Evaporated milk: Data represent production of unskimmed, unsweetened evaporated milk, case goods only. Ice Cream: Data represent production for wholesale distribution only.

Significant differences exist between changes in production of the various major dairy products. The first 6 years after World War I brought revolutionary changes in the butter industry (see figure 1.) Although the total number of plants decreased, total production increased tremendously and average production per plant increased 85 percent. From 1924 to 1933, average production per plant continued to increase slowly but rather consistently. It declined during the period 1933 to 1937 but again rose from 1937 to 1941. The effects of the war brought a decline from 1941 to 1946 but in 1949 average production per plant reached an all-time high of 450,000 pounds.

Average production per plant making American cheese rose sharply after World War I (figure 2). From 1923 to 1932 there was little change. During subsequent depression years, and in contrast to the situation in the butter industry, average production of American cheese rose sharply. With but few temporary reversals, it continued upward until by 1949 the average production per plant had reached 556,000 pounds. This was 5½ times the comparable figure for 1918.

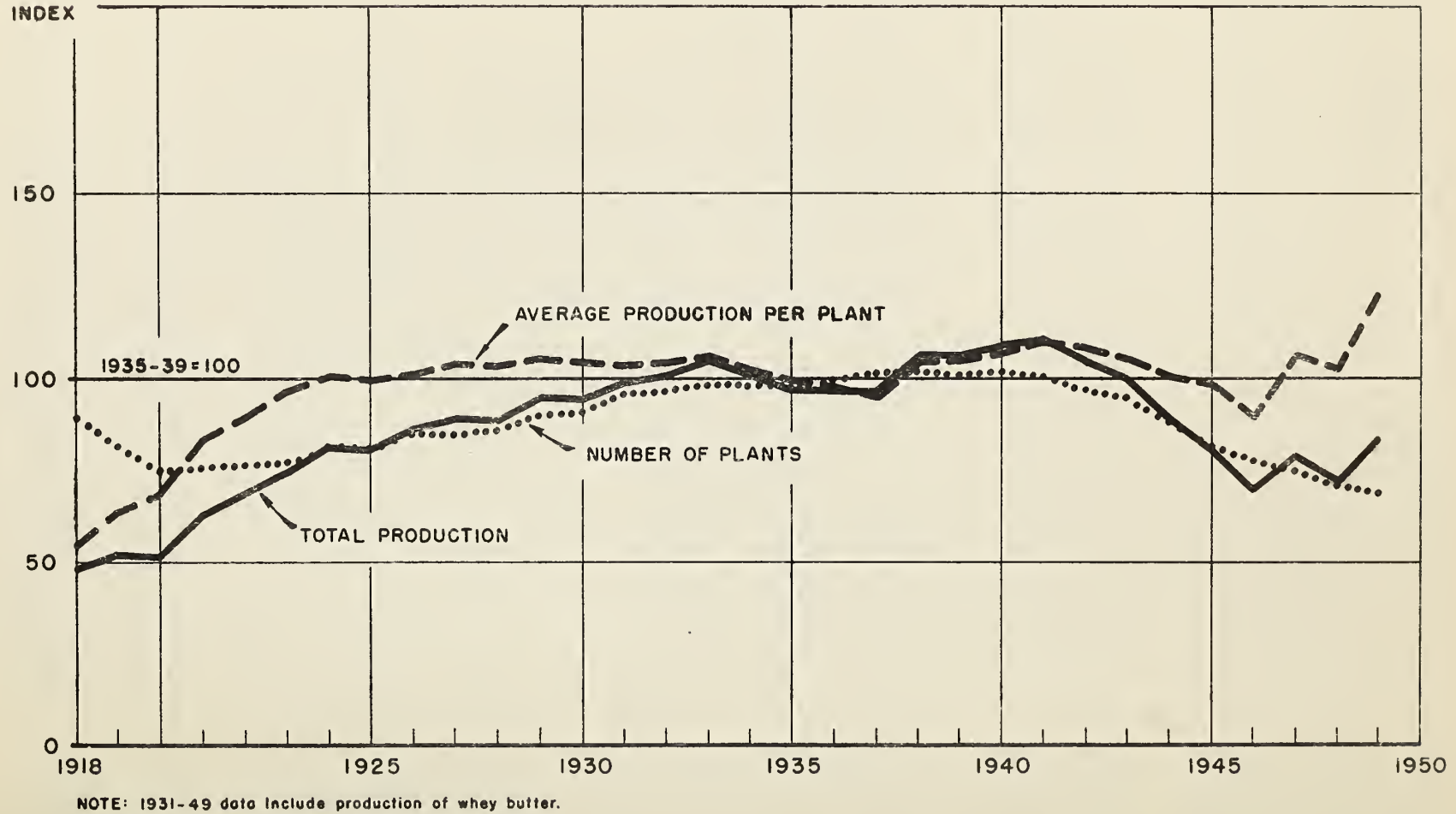
During the period 1933-49 the annual average production of American-cheese factories increased proportionately much more rapidly than that of creameries (figure 3). In each case the plants were smaller, on the average, in each of the principal producing States than in the country as a whole. The average production in 1949 of butter-making plants in Minnesota was 372,000 pounds compared with an average of 471,000 pounds for all other States combined. Average production of American-cheese plants in Wisconsin in 1949 was only 437,000 pounds compared with an average of 723,000 pounds for the plants in the other 47 States. These relationships are noteworthy because of the large number of cooperative associations concerned and the degree of competition which prevails in those States.

The situation in the dried skim milk industry has shown variation. During the 1918-23 period, there was an even greater increase in average production per plant than in the butter industry but, up to 1940, there was no further increase (figure 4). There was a very significant difference in trends in total production for the dried skim milk for human food (nonfat dry milk solids) and that produced for animal feed. In 1940, two-thirds of the total dried skim milk was produced for human food. The proportion rose rapidly and fluctuated from 96.8 to 98.1 percent during the period 1944 to 1949, inclusive. The plants producing dried skim milk for human food are considerably larger than the animal feed plants. In 1949, average plant production of human food was over 2 million pounds whereas that of animal feed was only about 90 thousand pounds per plant. Thus the shift in use of processing facilities contributed to an over-all increase in average production per plant. Average production of the plants producing nonfat dry milk solids was nearly twice as large in 1949 as in 1939 (figure 5).

There were fewer evaporated milk plants in the United States in 1942 than in 1918 but production was over 3½ times as great (figure 6). Changes in average production per plant correlated rather closely with

FIGURE 1

U. S. PRODUCTION OF CREAMERY BUTTER, 1918-49



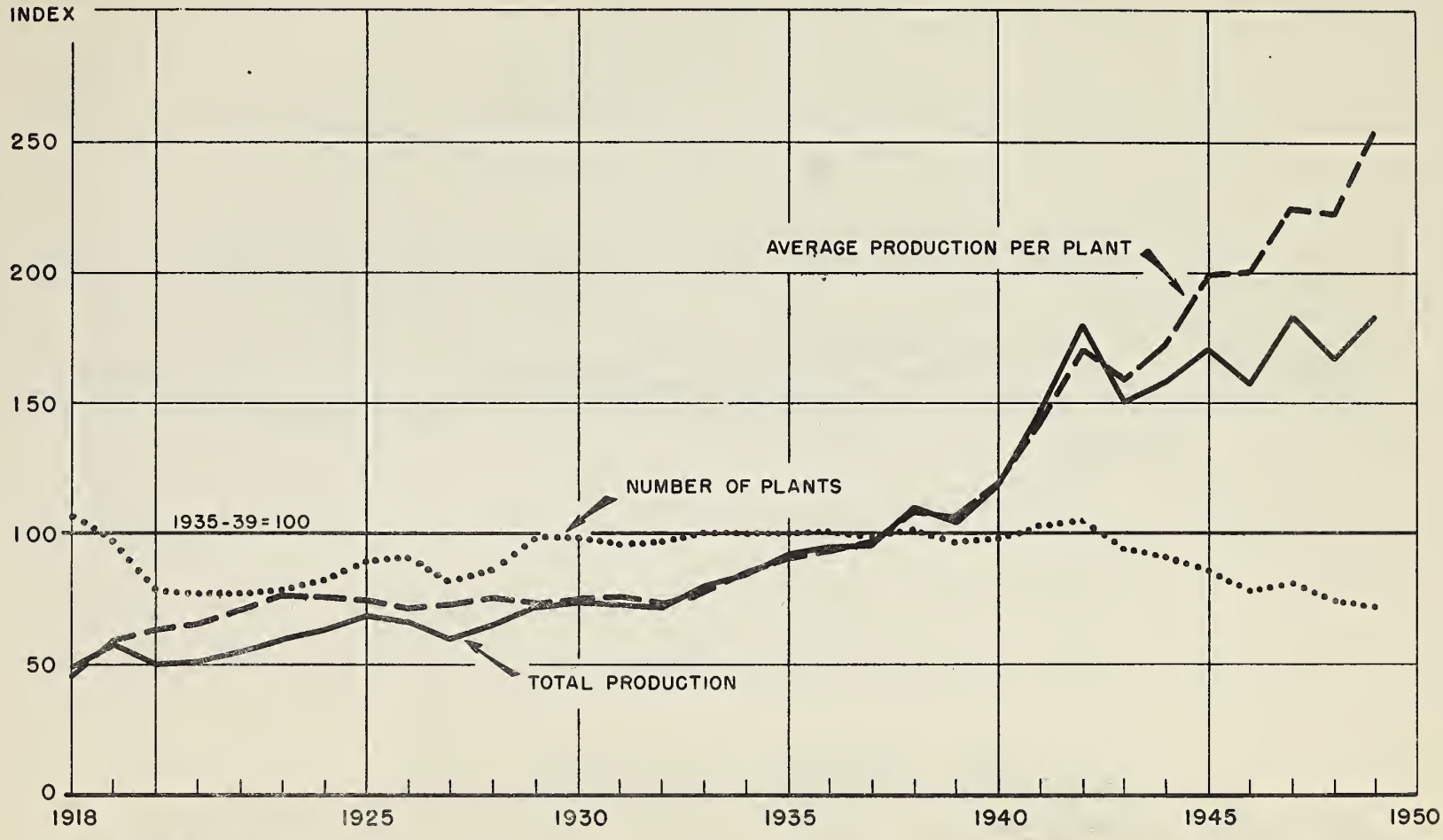
NOTE: 1931-49 data include production of whey butter.

SOURCE: Based on data compiled by B.A.E., U.S.D.A.

581-1

FIGURE 2

U. S. PRODUCTION OF AMERICAN CHEESE,• 1918-49



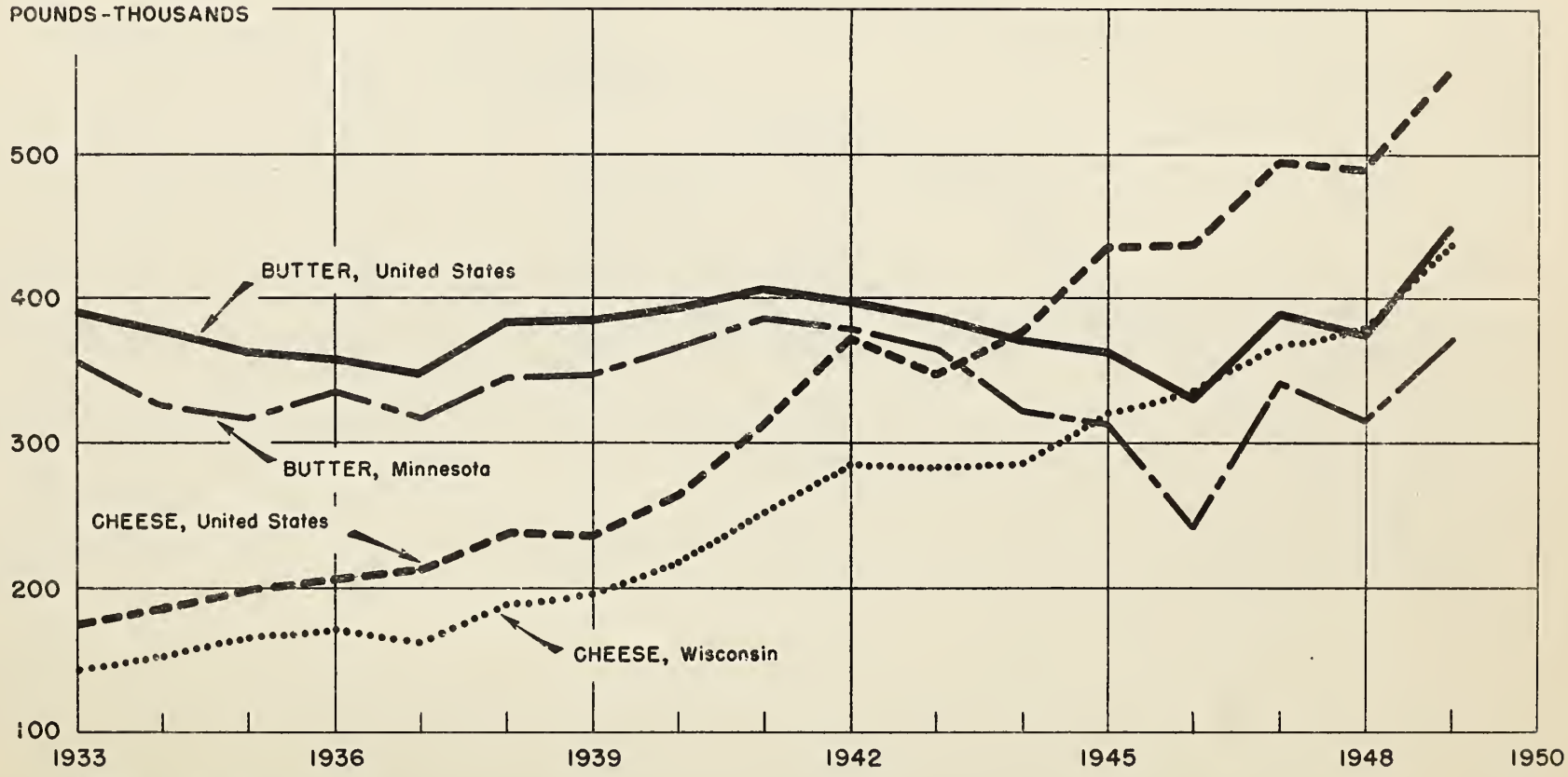
•Whole milk cheese only.

SOURCE: Based on data compiled by B.A.E., U.S.D.A.

581-2

FIGURE 3

AVERAGE PRODUCTION PER PLANT OF CREAMERY BUTTER● AND AMERICAN CHEESE,▲ 1933-49



●Includes whey butter.

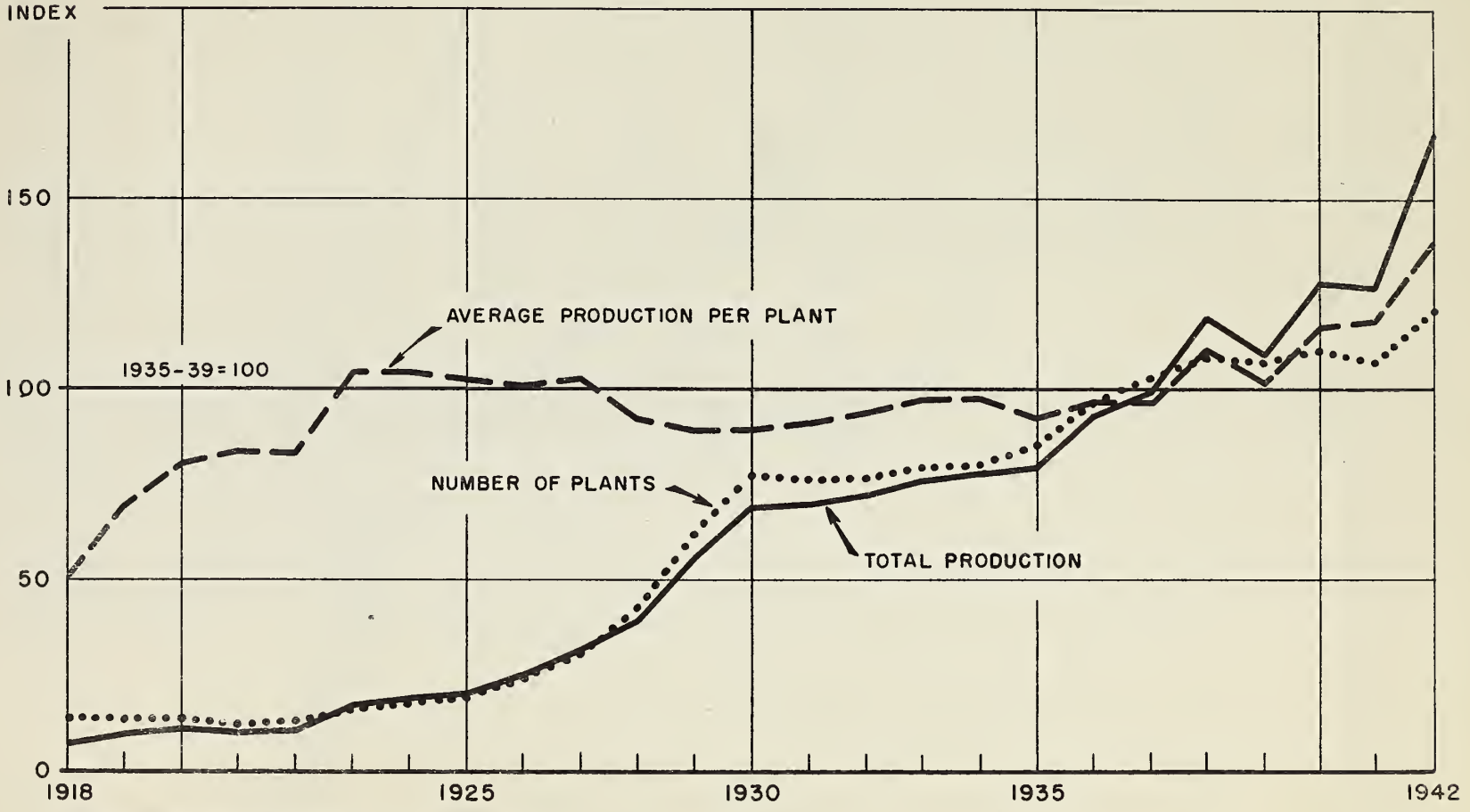
▲Includes whole milk cheese only.

SOURCE: Based on data compiled by B.A.E., U.S.D.A.

581-3

FIGURE 4

U. S. PRODUCTION OF DRIED SKIM MILK,● 1918-42



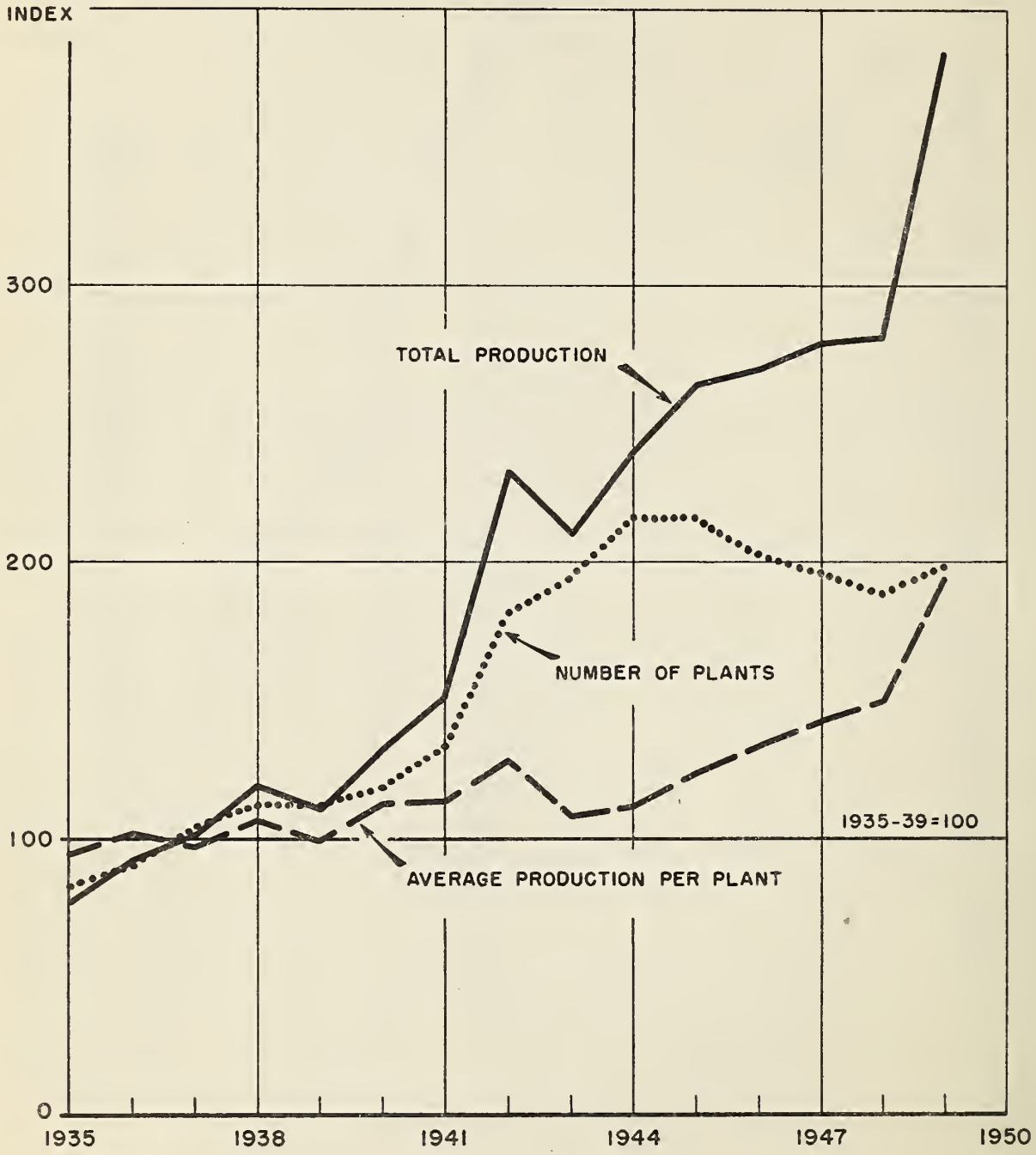
●Both human food and animal feed.

SOURCE: Based on data compiled by B.A.E., U.S.D.A.

581-4

FIGURE 5

U. S. PRODUCTION OF NONFAT DRY MILK SOLIDS 1935 - 49

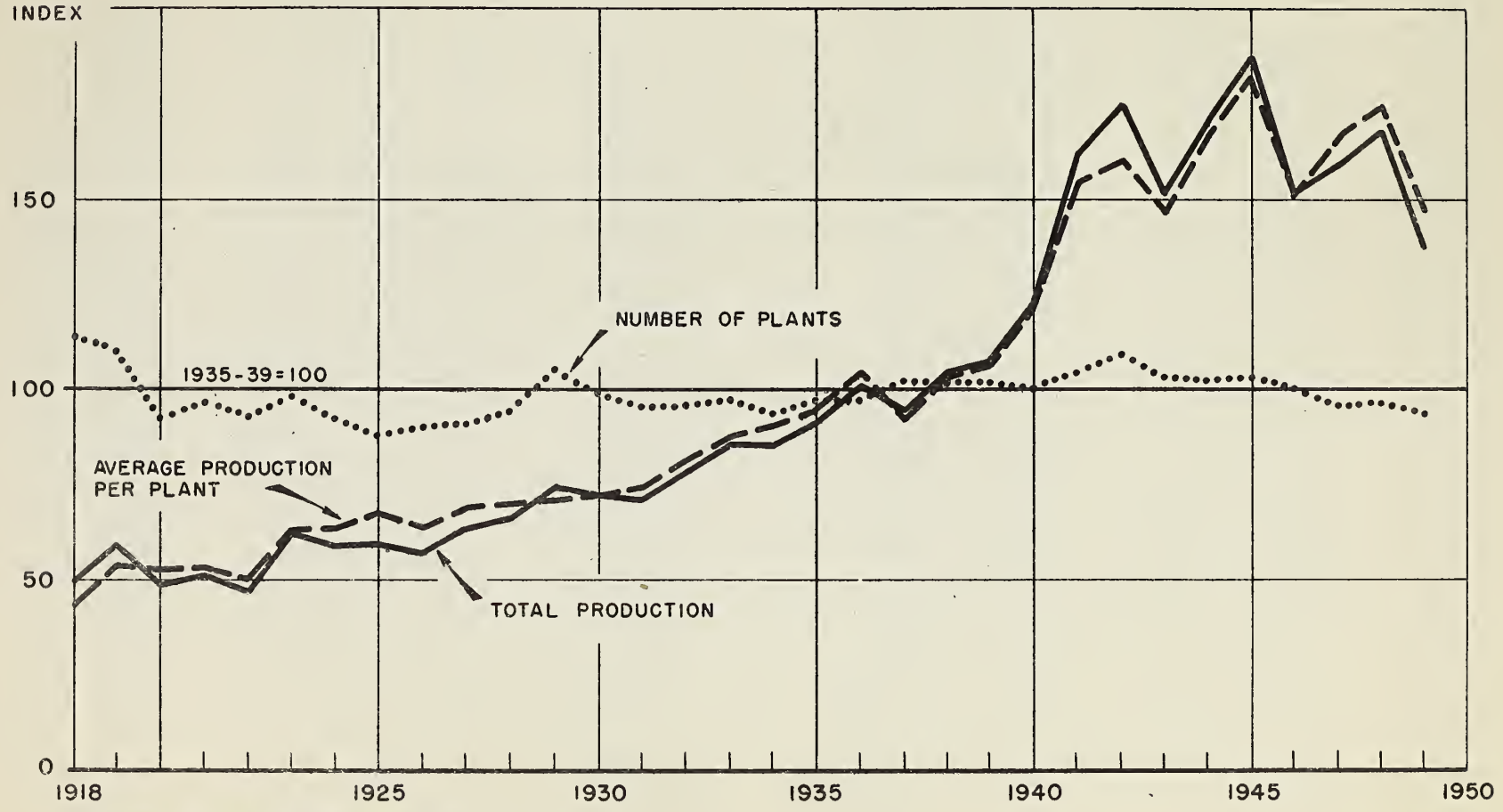


SOURCE: Based on data compiled by B.A.E., U.S.D.A.

581-5

FIGURE 6

U. S. PRODUCTION OF EVAPORATED MILK,• 1918-49



•Unskimmed, unsweetened, case goods only.

SOURCE: Based on data compiled by B.A.E., U.S.D.A.

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total production changes throughout the entire 25-year period. This relationship resulted from the fact that the number of plants remained relatively constant. Since 1942, average production per plant has fluctuated sharply but has remained well above prewar levels.

Production of ice cream for wholesale distribution increased tremendously from 1938 (when information was first assembled by the Bureau of Agricultural Economics) until 1946 (figure 7). Increases in average production per plant more than offset decreases in the number of plants. Thus, the trend toward large-scale plants has been very pronounced in the ice cream industry. Although only about one-fifth of the total number of ice cream plants produce ice cream for wholesale distribution, in 1949 they produced over 90 percent of the total output of that product.

At the end of the 12-year period 1938-49, American cheese ran a close second to nonfat dry milk solids in terms of the increase during the period in average production per plant (figure 8). Ice cream (wholesale) and creamery butter were also above their averages for the period but the average production per plant of evaporated milk in 1949 was slightly less than its average for the entire period. These relationships indicate that the trend toward large-scale dairy plants has been most effective in recent years for nonfat dry milk solids, American cheese, and ice cream.

Size Distribution of Plants According to Annual Production

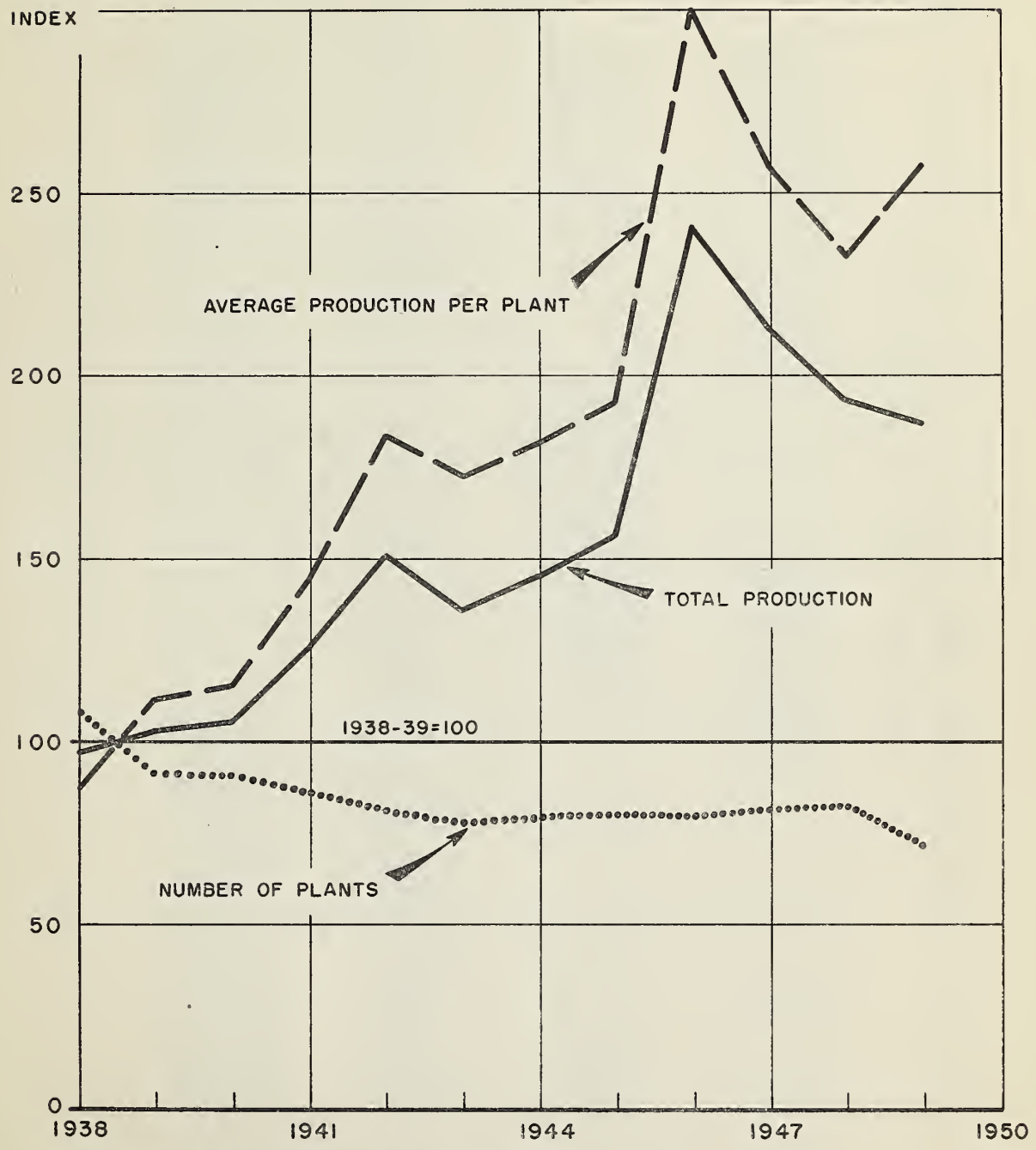
Increases in the number of large-scale American-cheese factories in Wisconsin are illustrated graphically in figure 9. Average production per plant has risen remarkably and not simply because of a tendency of large factories to become larger but partly because of an industry-wide trend toward increased size. The number of very small factories has shown a significant decrease.

If, for illustrative purposes, only those American-cheese factories which annually produce 500,000 pounds or more of cheese are classified as "large-scale" plants, then only 0.7 percent of the factories in Wisconsin in 1932 might have been termed "large-scale" (table 1). By 1937 this proportion was still only 1.9 percent, but in 1942 it was 10.8 percent and in 1947 it was 20.5 percent. Expressed in another way, in 1932 fewer than 1 plant out of 100 produced over a half million pounds of cheese. In 1947, 1 out of every 5 plants produced that much or more. This was a remarkable increase but a majority of the plants still are small.

The trend toward large-scale cheese plants is more effectively demonstrated by the data in table 1 than by simple average per plant figures. Comparable data for the other product-branches of the dairy industry have not been compiled. However, no segment of the dairy industry is entirely free from the effects of the development.

FIGURE 7

U. S. PRODUCTION OF ICE CREAM (Wholesale) 1938-49

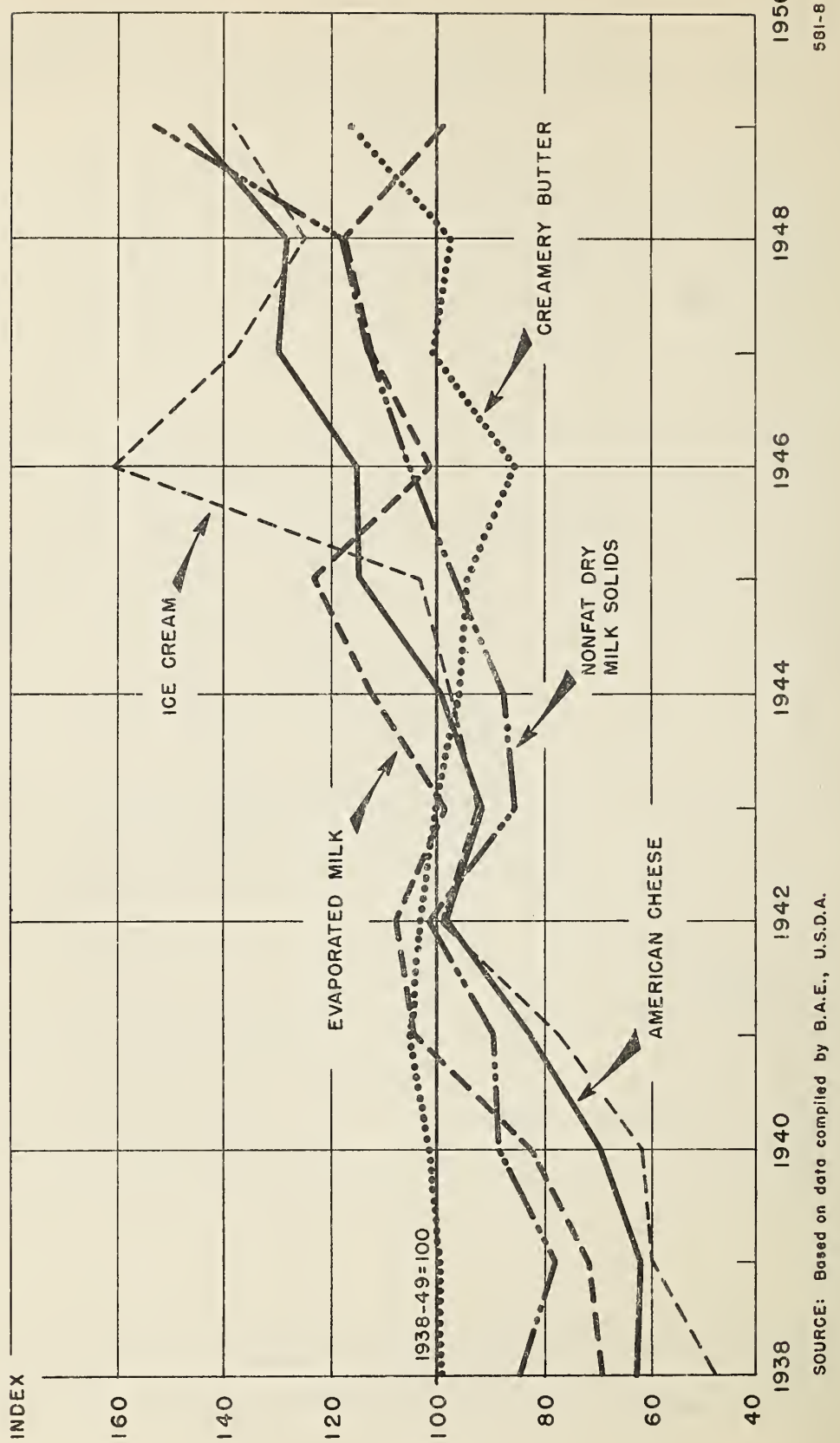


SOURCE: Based on data compiled by B.A.E., U.S.D.A.

581-7

FIGURE 8

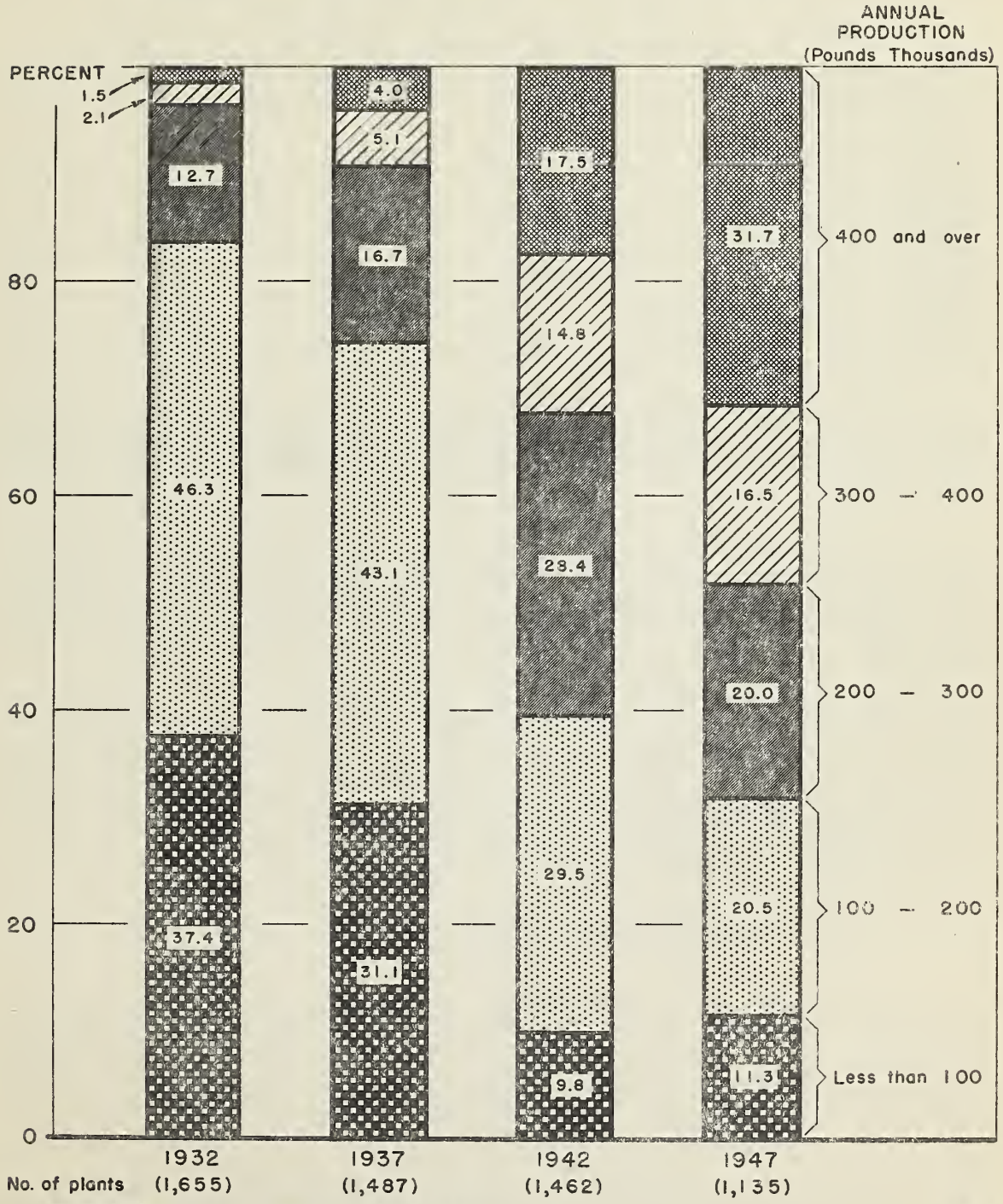
AVERAGE PRODUCTION PER PLANT, PRINCIPAL DAIRY PRODUCTS UNITED STATES, 1938-49



SOURCE: Based on data compiled by B.A.E., U.S.D.A.

FIGURE 9

AMERICAN-CHEESE FACTORIES IN WISCONSIN: PERCENTAGES OF TOTAL NUMBER OF PLANTS CLASSIFIED BY ANNUAL PRODUCTION



SOURCE: Based on data compiled by B.A.E., U.S.D.A.

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Table 1. - American-cheese factories in Wisconsin: Percentages of total number of plants included in indicated size groups based on annual production, 1932, 1937, 1942, 1947[a]

ANNUAL PRODUCTION OF AMERICAN CHEESE	1932 (1,655 plants)	1937 (1,487 plants)	1942 (1,462 plants)	1947 (1,135 plants)
Pounds	*Percent*			
Under 100,000	37.4	31.1	9.8	11.3
100,000 - 199,999	46.3	43.1	29.5	20.5
200,000 - 299,999	12.7	16.7	28.4	20.0
300,000 - 399,999	2.1	5.1	14.8	16.5
400,000 - 499,999	0.8	2.1	6.7	11.2
500,000 - 599,999	0.3	0.7	4.0	6.9
600,000 - 699,999	0.1	0.3	2.4	4.6
700,000 - 799,999	0.1	0.1	1.3	2.4
800,000 - 899,999	0.0	0.2	0.8	2.0
900,000 - 999,999	0.1	0.3	0.4	1.4
1,000,000 and over	0.1	0.3	1.9	3.2
Total	100.0	100.0	100.0	100.0

[a] Includes all factories making American cheese, not just specialized plants making that product.

Source of data: Compiled from records of the Bureau of Agricultural Economics, U. S. Department of Agriculture.

One way to measure the trend toward large-scale dairy plants is to consider the relative importance of the large and small plants in terms of the proportion of total production that is manufactured in designated size-classes of plants. The results of such a comparison were published recently.[2]

This study showed that plants producing annually over 400,000 pounds of American cheese accounted for only one-tenth of the total Wisconsin production in 1933, two-fifths in 1944 and two-thirds in 1949. Only one-fifth of the total output in 1949 was made in plants producing less than 300,000 pounds annually whereas in 1933, over four-fifths of the total production came from plants in that size range.

Annual Average Receipts of Milk Per Plant

A common method of determining the relative sizes of dairy plants, classified according to the principal product manufactured, is to compare receipts of whole milk or milk equivalent. This may be done on the basis of annual average receipts per plant, or by size groupings of plants established according to volumes of annual receipts.

[2] Wisconsin Department of Agriculture. *Cheese Production by Size of Plant,* Wisconsin Dairying, Vol. 1, No. 11, 4 pp. 1950. See p. 4.

The following table affords a comparison of average sizes of the principal types of dairy plants for 6 of the last 30 years.

Table 2. - Estimated annual average receipts of milk on a milk equivalent basis, at dairy plants in the United States classified according to type of product manufactured, 6-year intervals, 1918-48

PRINCIPAL PRODUCT MANUFACTURED	AVERAGE RECEIPTS PER PLANT OF MILK OR MILK EQUIVALENT USED IN PRINCIPAL PRODUCT MANUFACTURED					
	1918	1924	1930	1936	1942	1948
	1,000 pounds					
Creamery butter[a]	4,172	7,718	8,020	7,507	8,353	7,884
American cheese[b]	1,021	1,677	1,649	2,057	3,721	4,883
Dried skim milk	[c]3,677	[c]7,691	[c]6,578	[d]8,609	[d]10,795	[d]12,534
Evaporated milk[e]	13,704	19,981	22,772	32,819	50,264	54,723
Ice cream[f]	-	-	-	-	1,641	2,081

[a] Data for the years 1918, 1924, and 1930 are for creamery butter alone; data for the years 1936, 1942, and 1948 include the number and production of plants manufacturing whey butter. Receipts include milk equivalent of farm-separated cream.

[b] Whole milk cheese only.

[c] Both human food and animal feed.

[d] Human food only.

[e] Unskimmed, unsweetened, case goods only.

[f] Includes only that produced for wholesale distribution. Comparable data not available for the selected years prior to 1942.

Source of data: Compiled from records of the Bureau of Agricultural Economics, U. S. Department of Agriculture. Annual average receipts for each type of plant were computed by multiplying the total production figure by the appropriate USDA conversion factor (quantity of milk to which 1 pound of product is equivalent) and then dividing by the appropriate number of plants.

It is apparent from table 2 that not all product-branches of the dairy industry are converting to large-scale units at the same rate. It is difficult to measure the differences, however, because the figures for receipts at creameries are not directly comparable with those for receipts at other types of plants. The creamery figures are inflated in proportion to the quantity of farm-separated cream which they represent. The actual receipts of cream and milk were much lower than the milk equivalent figures indicate because most of the milk, from which the cream was separated, never left the farms.

A further defect in this method of comparison is the fact that it does not allow for the different uses of a given quantity of whole milk. A number of dairy products may be produced from the milk and, when the milk equivalent figures are used, the total quantity of whole milk utilized by all products is shown as having been utilized in each product. This fault may be corrected by limiting comparisons to a butterfat basis, but then no recognition can be given to the large quantities of dairy products made from skimmed milk.

COMPARATIVE PRODUCTION OF COOPERATIVE AND NON-COOPERATIVE PLANTS

It has been considered impracticable to attempt to measure changes over a period of years in the relative sizes of non-cooperative and cooperative dairy plants. If lists were available to show which plants operating in given States in given years were non-cooperative, which were cooperative, which had changed from one type of ownership to the other and when they had changed, the task would be relatively simple. In the absence of such lists, however, it has appeared desirable to make a size comparison for only 1 recent year for which the information could be acquired.[3]

Probably more non-cooperative organizations than cooperative associations operate plants that produce butter and American cheese as byproducts. Data are not available to support this assumption, but the fact that a majority of the milk-distributing plants are operated by non-cooperative organizations offers some supporting evidence. This relationship is important only in considering the smallest size-groups of plants, however, as plants producing quantities of a product sufficient to be entered in the larger size-groups would not be producing it merely as a byproduct.

Similarly, the fact that the data include the number and production of plants going out of business during the calendar year is important only in considering the smallest size-groups. Probably a majority of the plants going out of business are, whether cooperatively or otherwise owned, smaller than the average in the industry.

Creameries in Minnesota[4]

Over one-sixth of the creamery butter produced in the United States in 1949 was produced in Minnesota.[5] Over 40 percent of the cooperative buttermaking associations in the United States are in that State.[6] Over three-fourths of the total quantity of butter produced in Minnesota in 1949 was manufactured in cooperative plants.[7] The organizations making butter in that State thus afford a good indication of the average sizes of creamery plants throughout the United States operated by cooperatives and by non-cooperatives.

[3]Some comparison can be made of the size of cooperative cheese factories in Wisconsin in 1926 and in 1942. Table 11 illustrates the changes which occurred. Production figures for the 2 years are not exactly comparable, however, because the data for 1926 pertain to all varieties of cheese whereas the data for 1942 pertain to American cheese only.

[4]The word "creamery" as used herein includes all buttermaking establishments and not just those specializing in butter production.

[5]Estimate based on production figures in: *Production of Manufactured Dairy Products, 1949.* U. S. Department of Agriculture, Bureau of Agricultural Economics. 48 pp. November 1950. See pp. 10 and 15. (Processed)

[6]Estimate based on records of the Farm Credit Administration.

[7]Minnesota Department of Agriculture, Dairy and Food. *Bulletin of Information, 1950.* 90 pp. 1951. See p. 14.

Cooperative creameries in Minnesota in 1942 were, on the average, almost exactly the same size as creameries operated by non-cooperative organizations. Production by the cooperatives averaged 378,000 pounds as compared with 380,000 pounds for the other plants.[8]

There were significant differences, however, in the size distributions of cooperative and non-cooperative plants (table 3). More than 45 percent of the latter produced less than 175,000 pounds during 1942; slightly over 19 percent of the cooperative plants produced less than that quantity. A considerably larger percentage of non-cooperative plants than of cooperative plants produced over a million pounds of butter during the year.[9] These relationships are illustrated graphically in figure 10.

Information published recently indicates that butter production by cooperative creameries in Minnesota averaged 360,000 pounds in 1949.[10] This was considerably higher than the average of independent non-cooperative creameries but much less than for the "centralizers." The average in 1949 for all butter-making plants in the State was about 372,000 pounds.

[8]Estimate based on a Farm Credit Administration survey. Cooperative plants identified as such from FCA records; production figures compiled from records of the Bureau of Agricultural Economics, U. S. Department of Agriculture.

[9]There were so many more cooperatively operated plants in the State, however, that the actual number of cooperative plants producing more than a million pounds of butter was 50 percent greater than the number of private plants producing more than that quantity.

[10]See pages 13 and 14 of reference cited in footnote 7.

Table 3. - Creameries in Minnesota: Percentages of total numbers of cooperative and non-cooperative plants included in indicated size groups based on annual production, 1942[a]

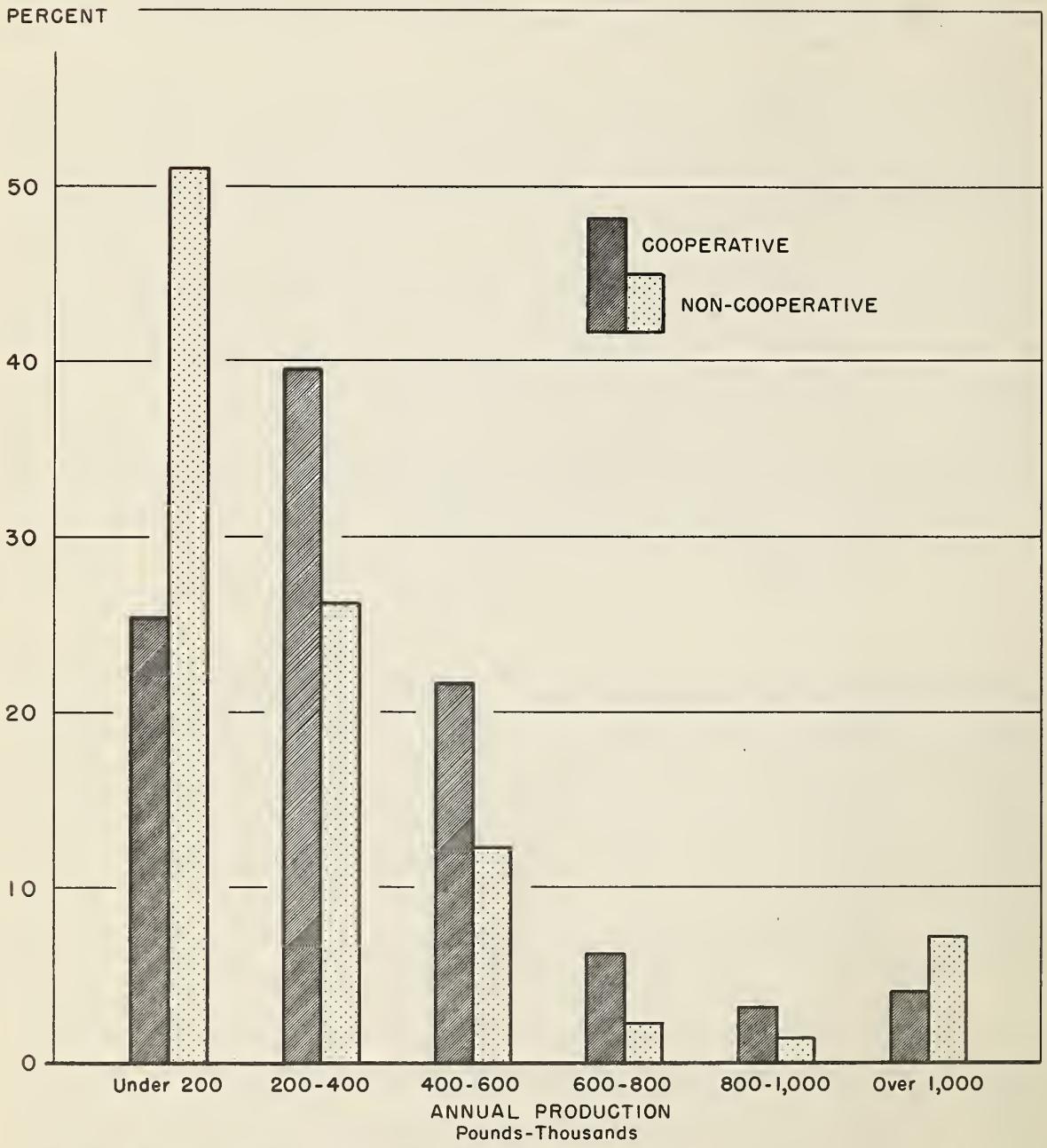
ANNUAL PRODUCTION OF BUTTER	609 COOPERATIVE PLANTS	222 NON-COOPERATIVE PLANTS	ALL 831 PLANTS
Pounds	*Percent*		
Under 100,000	5.9	23.4	10.6
100,000 - 199,999	19.5	27.5	21.7
200,000 - 299,999	22.3	19.4	21.5
300,000 - 399,999	17.3	6.8	14.4
400,000 - 499,999	13.0	9.5	12.0
500,000 - 599,999	8.7	2.7	7.1
600,000 - 699,999	4.1	0.9	3.3
700,000 - 799,999	2.1	1.3	1.9
800,000 - 899,999	1.8	0.4	1.5
900,000 - 999,999	1.3	0.9	1.2
1,000,000 and over	4.0	7.2	4.8
Total	100.0	100.0	100.0

[a] Includes all plants making creamery butter and whey butter, not just specialized plants making those products.

Source of data: Cooperative plants identified as such from Farm Credit Administration records; production figures were compiled from records of the Bureau of Agricultural Economics, U. S. Department of Agriculture.

FIGURE 10

COOPERATIVE & NON-COOPERATIVE CREAMERIES, MINNESOTA: PERCENTAGES OF TOTAL NUMBER OF PLANTS CLASSIFIED BY ANNUAL PRODUCTION, 1942



SOURCE: Based on records of F.C.A. and B.A.E., U.S.D.A.

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American-Cheese Factories in Wisconsin[11]

Almost one-half of the American cheese made from whole milk in the United States in 1949 was manufactured in Wisconsin.[12] Nearly three-fourths of the cooperative cheese factories in the United States are in that State. About two-thirds of that group manufacture American cheese.[13] Slightly less than one-quarter of the American cheese produced in Wisconsin in 1942 was manufactured in cooperative plants.[14]

The cooperative American-cheese factories in Wisconsin in 1942 were, on the average, slightly larger than the non-cooperative factories. Production of the former averaged about 294,000 pounds for the year compared with 283,000 pounds for the latter. Only 6.8 percent of the cooperative factories produced less than 100,000 pounds of American cheese during the year; 10.6 percent of the non-cooperative factories produced less than that quantity. Further differences are illustrated in table 4.

In actual numbers of large plants, however, the non-cooperative concerns led the cooperatives. There were only 18 cooperative plants (5.5 percent) that produced over 600,000 pounds of cheese; and 81 non-cooperative plants (7.1 percent) produced more than that quantity.

[11]The term "American-cheese factories" is used in this section of the report to include all American-cheese-making establishments and not just those specializing in the manufacture of that particular variety of cheese.

[12]See page 22 of reference cited in footnote 5.

[13]Estimate based on records of the Farm Credit Administration.

[14]Estimate based on a Farm Credit Administration survey. Cooperative plants identified as such from FCA records, and production figures compiled from records of the Bureau of Agricultural Economics, U. S. Department of Agriculture.

Table 4. - American-cheese factories in Wisconsin: Percentages of total numbers of cooperative and non-cooperative plants included in indicated size groups based on annual production, 1942[a]

ANNUAL PRODUCTION OF AMERICAN CHEESE	322 COOPERATIVE PLANTS	1,140 NON-COOPERATIVE PLANTS	ALL 1,462 PLANTS
Pounds	*Percent*		
Under 100,000	6.8	10.6	9.8
100,000 - 199,999	32.6	28.6	29.5
200,000 - 299,999	28.3	28.4	28.4
300,000 - 399,999	14.9	14.8	14.8
400,000 - 499,999	7.2	6.6	6.7
500,000 - 599,999	4.7	3.9	4.0
600,000 - 699,999	1.2	2.7	2.4
700,000 - 799,999	0.9	1.4	1.3
800,000 - 899,999	0.3	0.9	0.8
900,000 - 999,999	0.6	0.3	0.4
1,000,000 and over	2.5	1.8	1.9
Total	100.0	100.0	100.0

[a]Includes all factories making American cheese (from whole milk) not just specialized plants making that product.

Source of data: Cooperative plants identified as such from Farm Credit Administration records. Production figures were compiled from records of the Bureau of Agricultural Economics, U. S. Department of Agriculture.

Differences in the size distributions of the cooperative and other American-cheese factories are illustrated in figure 11. These differences do not follow the same pattern as those between cooperative and non-cooperative creameries in Minnesota (figure 10). Unlike the case in the creamery industry, there is no apparent tendency in the American-cheese industry for relatively larger numbers of the non-cooperative plants to fall within both the smallest and the largest size groups. The data do not permit comparisons to be made between the different non-cooperative plants on the basis of their types of proprietors. Such a comparison would probably show that a majority of the smaller non-cooperative plants are independently owned and that many of the larger ones are owned by the local and national chains.

Nonfat Dry Milk Plants in Minnesota

Well over half of the dried milk produced in the United States is manufactured by farmers' cooperatives. Minnesota is second only to Wisconsin in terms of total output. Thus it is apparent that conditions in Minnesota bear an important relationship to the national situation in the milk drying industry. A study made in 1949 gives some indication of the size of the milk drying plants in Minnesota in 1948.[15]

Over one-fourth of the Minnesota milk drying plants produced less than 200,000 pounds of dried milk in 1948.[16] However, half of them produced over 1 million pounds and 1 out of 10 produced over 5 million pounds.

Average production per plant of nonfat dry milk solids was as follows:[17]

	1948 production
	(1,000 pounds)
Cooperatives:	
Regionals	2,780
Locals	1,501
Average	1,869
Non-cooperatives:	
Local independents	864
Branches of national corporations	1,208
Average	979
All plants	1,629

Thus the average cooperative plant produced almost twice as much nonfat dry milk solids as the average non-cooperative plant. Contrary to the situation in most product branches of the dairy industry, average production of local cooperative plants exceeded that of plants operated by national non-cooperative organizations.

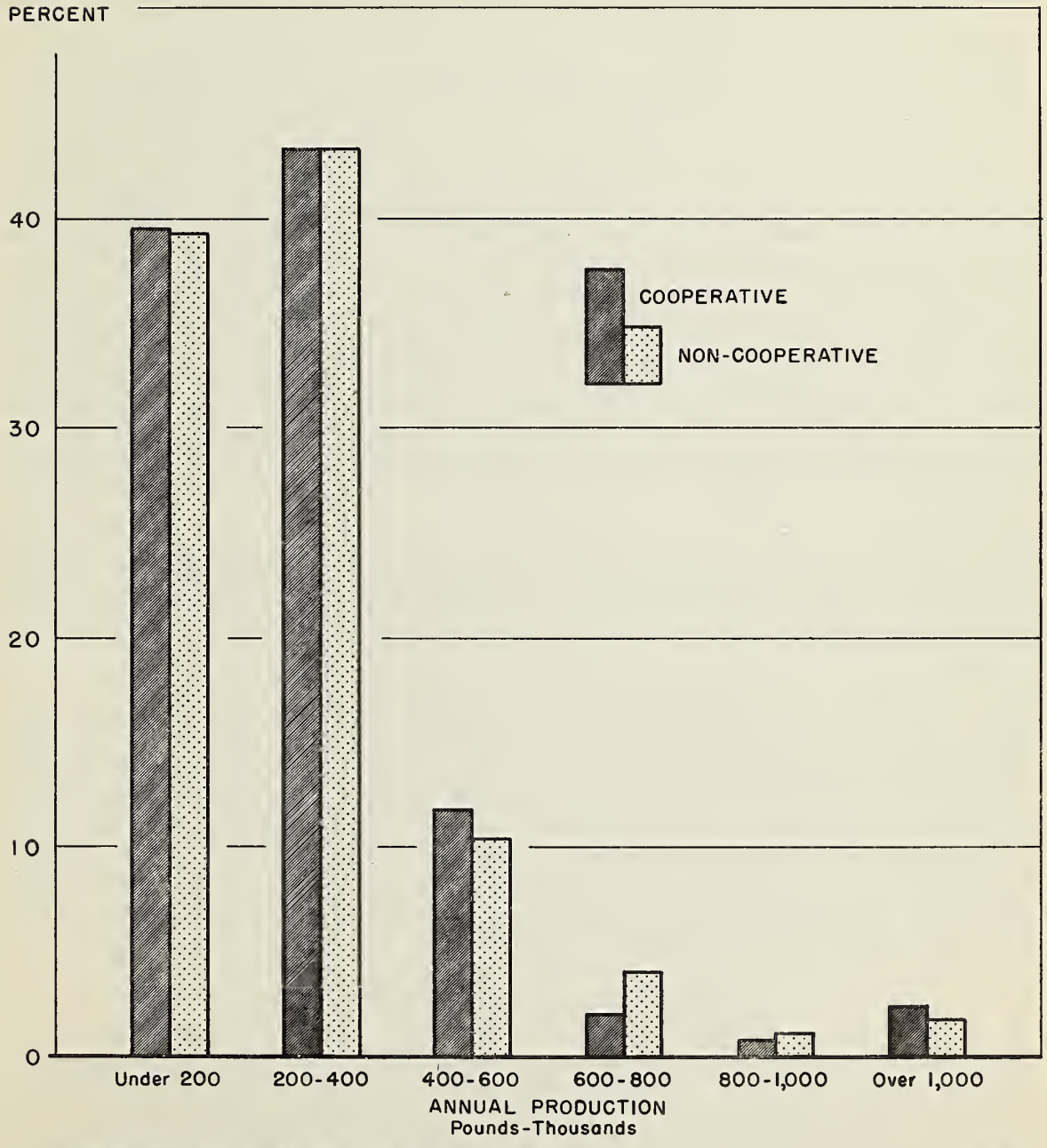
[15]Butz, D. E. and Koller, E. F. *The Minnesota Dry Milk Industry 1948.* University of Minnesota, preliminary report, 22 pp. 1949. (Processed) See p. 4.

[16]Including other dried milk products in addition to nonfat dry milk solids.

[17]Data given were derived from information in reference cited in footnote 15.

FIGURE 11

COOPERATIVE & NON-COOPERATIVE AMERICAN-CHEESE FACTORIES, WISCONSIN: PERCENTAGES OF TOTAL NUMBER OF PLANTS CLASSIFIED BY ANNUAL PRODUCTION, 1942



SOURCE: Based on records of F.C.A. and B.A.E., U.S.D.A.

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General Relationships

The relative sizes of other dairy plants in a plant's competitive area are more important to each dairy cooperative than the State or national production averages for plants of the type it operates. The State averages are significant because of the assumption that a greater number of below-average-size plants will be eliminated by competition than of above-average-size plants. However, the fact that a given cooperative plant is larger than the State average for that type of plant is no assurance that it will be able to successfully compete with the other dairy plants in its own locality.

In regard to dairy plants of a specialized type, assuming conditions other than type of proprietorship to be the same, the small non-cooperative plant probably has less chance to survive than the small cooperative plant. The interests of producers are to a much greater extent involved in the financial welfare of the latter. Furthermore, the value to producers of a cooperative plant cannot be measured only in terms of the price the producers receive for their milk or cream. For these reasons, the producers may maintain their plant, for a time at least, even after it has outlived its economic usefulness. This nontechnical factor strengthens the competitive position of each cooperative plant but it may, when a plant cannot survive, eventually cause greater financial loss to the producers than would have been incurred by the owner of a non-cooperative plant. When the need for such a plant or association no longer exists, it should be eliminated and the cooperative effort of the producers directed into the more effective channels offered by larger plants and associations.

There has been a very marked decline in numbers of plants in the major production areas. Cooperatives now operating plants in those areas must be particularly vigilant in order to serve best the interests of their producer-patrons.

One significant fact is not shown by the data presented herein. With their chains of plants and variety of sales outlets, the national and regional non-cooperative dairy companies may be the most effective competitors of dairy cooperatives. Large-scale cooperative marketing associations may meet this challenge at the distribution level but only large-scale plants will be able to meet it at the production level. Consolidation of plants can be effected by large non-cooperative companies as well as by cooperative associations. The latter cannot afford to lag behind in the competitive race.

REASONS FOR DEVELOPMENT OF THE TREND

Competition, of course, is the basic economic force which gave rise to, and has perpetuated, the development of the trend toward large-scale dairy plants. In order to justify and maintain their existence, all dairy plants and all cooperative associations must have something of

value to offer to patrons. The inducement for patronage may or may not be economic in nature. Business competition is largely economic, however, and the trend has developed as a result of economic conditions.

Some of the specific technical reasons for the development of the trend are discussed below in order to assist in evaluating the significance of the trend, and in developing comprehensive appraisals of individual competitive situations.

IMPROVEMENTS IN TRANSPORTATION FACILITIES AND TECHNIQUES

Improvements in transportation facilities and techniques have resulted in cheaper, faster, and more dependable delivery of milk and cream to plants. They have also permitted tremendous improvements in the quality of those raw materials when received at the plants.

Furthermore, these improvements have greatly increased the size of the geographic area from which an individual dairy plant can profitably procure milk and cream. As a result, the procurement areas of many plants have overlapped with those of other dairy plants in their locality. The latter condition has been particularly true in the areas where dairying was established on a major scale before the advent of the relatively recent transportation developments. Competition has, therefore, increased in such areas, and the advantages of a large volume of business are of particular importance to every plant located in one of them.

The principal recent improvements in transportation, in relation to the trend toward large-scale dairy plants, are as follows:

1. Highways. Because of increased average width and a greater number of hard surfaced roads, highways can bear more and heavier traffic than they could a few years ago. More direct routes and a more extensive system reduce the hauling distance from farms to the plants at which the milk is received and from the plants to urban consuming areas. Development of efficient snow-removal equipment permits year-round delivery of milk to plants.

2. Trucks. Modern trucks, which can be operated in accordance with efficient trucking techniques, have replaced slow and relatively costly horse-drawn wagons and sleighs, both for hauling milk to plants and for transporting the finished dairy products to buyers.

3. Railroads. Speedier deliveries, extension of lines, and refrigeration service have increased the maximum distances for which milk and milk products may be safely transported by rail.

A fourth development that may further accelerate the trend toward large-scale plants is the introduction of fresh concentrated milk. This product can be transported at considerably less cost than fresh whole milk. If the product is acceptable to consumers as now seems likely, competition between plants in various geographic areas will become more keen than at present.

ADVANTAGES OF LARGE VOLUME OF BUSINESS

An increase in volume of production often results in an increase in net income. This permits a cooperative association to (1) make such changes in plant facilities and marketing methods as are desirable, (2) accumulate adequate capital for all purposes, (3) offer more services to producers, (4) make a reasonable rate of return to producers on money invested in the association, and (5) increase the money payments to producers for the milk they deliver to the association.

Specifically, the advantages of a large volume of business are as follows:

1. Operating efficiency. To some point beyond the average-size plant in the industry, manufacturing costs per unit of product usually decrease as volume increases.[18] Fixed costs per unit of product manufactured also decrease. This increase in general operating efficiency is perhaps the greatest single advantage of possessing a large volume of business. Most of the dairy cooperatives that have gone out of business during recent years have been, according to reports received by the Farm Credit Administration, associations which operated small plants. Lack of sufficient volume of business was often given as the specific reason for the cessation of plant operations.

2. More complete utilization of milk solids. Recent nutritional discoveries and the war-stimulated demand for dairy products will have lasting effects on the dairy industry. The plants that can use all or most of the milk solids, by producing by-products, will be able to pay more for the milk they receive. This highly important development favors the construction and expansion of large-scale plants. Some byproducts cannot be produced efficiently in plants receiving only an average volume of milk.

3. Competent manager. The ability of the manager is usually one of the most important factors determining the success or failure of a dairy cooperative. An association operating a small-scale plant usually cannot compete effectively for the services of an efficient manager with an association operating a large-scale plant.

4. Specialized personnel. The magnitude of operations of a plant with a large volume of business requires a greater number of workers than may be profitably utilized in a plant with a small volume of business. In a small-scale plant, each man must perform a number of diverse duties; in a large-scale plant, specialists may be employed to perform certain specific functions.

[18] A large number of published statements, as well as the experience of most plant operators, have conclusively established the fact that there is a relationship between plant operating costs and the volume of receipts of milk or cream. Table 14 of this report offers some supporting evidence. See also pp. 11-14 of the report cited in footnote 15. Two of the most intensive studies of the relationship were reported in the following publications: (1) Bressler, R. G., Jr., *Economies of Scale in the Operation of Country Milk Plants, With Special Reference to New England.* The New England Research Council on Marketing and Food Supply and others, 92 pp. 1942. (2) Henry, W. F., Bressler, R. G. Jr., and Frick, G. E., *Economies of Scale in Specialized Pasteurizing and Bottling Plants.* Storrs Agricultural Experiment Station, University of Connecticut, Bulletin 11 in a series on *Efficiency of Milk Marketing in Connecticut,* 61 pp. 1948.

5. Quality of products. As a result of technological advantages, the ability to pay a premium for high quality milk, and the opportunity to make profitable use of the services of fieldmen, an increase in volume of business will usually permit an increase in the average quality of the product or products produced. In the absence of governmental maximum price control, an increase in quality ordinarily results in a higher average selling price for the product.

6. Standardization of products. Standardization of products presents one of the greatest opportunities for progress by cooperative dairy associations. Greater uniformity of quality and physical appearance of each product are usually more easily achieved in a large-scale plant than in a small-scale plant.

7. Brand name. If a product is of dependably uniform quality and can be produced in sufficient year-round volume, use of a brand name usually results in a price premium.

8. Yield of product. Increased efficiency of operations derived from increased volume may result in a greater yield of the final product (of given composition) from each unit quantity of milk. Some losses of raw product in the plant, such as the loss of butterfat which has adhered to the walls of separators and connecting pipes, do not increase in direct proportion to increases in the volume of product handled.

9. Sales outlets. If a plant can produce a large volume of product, in "normal" times there may be available certain outlets for its products that would otherwise be closed. Ordinarily, the greater the degree of selectivity of outlets the greater the return on sales of the product. Furthermore, as compared with an association distributing a small volume of product, one with a large volume will have greater price bargaining power irrespective of the particular sales outlet selected.

10. Reduced costs of distribution. Large shipments of dairy products can be made at lower costs per unit of product than small shipments. The association with a large volume of business may also be able to eliminate several marketing steps for its product and to retain the savings thus effected. In addition, it may adopt more efficient and effective methods of merchandising products. In general, however, regional and national cooperative marketing associations appear to offer the most satisfactory answer to the problems of distributing dairy products cooperatively.

11. Services to patrons. Associations operating large-scale plants can extend a greater number of services to patrons than can the associations with small plants. This is true in regard to selling farmers' milk, purchasing supplies which farmers need, and employing fieldmen.

12. Machines. Certain types of plant and office machines that can be operated more efficiently than others require a large volume of business in order to operate efficiently enough to compensate for the additional costs involved. For certain processes, such as dehydration of milk for use as human food, there are no machines that can be operated efficiently with a small volume of milk. Other plant operations, such as packaging, are also particularly dependent on a large volume of production if costs are to be held to reasonable levels.

13. Research. A large volume of business may present an opportunity for extensive research. The importance of research devoted to the many phases of manufacturing and distributing dairy products must be appreciated by members of farmers' cooperatives if their associations are to progress.

ADVANTAGES OF OPERATIONAL DIVERSIFICATION

A large-scale plant is not necessarily diversified but a diversified plant usually has to be large-scale to be profitable.[19] The importance of utilization of all the milk solids was discussed in a preceding section of this report; such utilization can be achieved in the multiple-process diversified plant. The ability to shift production is also important. The success or failure of a diversified plant need not hinge on the price of a single product. On the contrary, such a plant can, under some conditions at least, produce the combination of dairy products that will make greatest net returns to milk producers.

A reasonably diversified plant may thus be in a particularly strong position with respect to competition from within and without the dairy industry.[20] Furthermore, as a profitable year-round outlet for the farmers' milk, it may have more dependable sources of supply than a specialized large-scale plant.

It should be noted that large-scale organizations can achieve diversification of operations in regard to both production changes and utilization of milk solids through direction of operations in a number of small plants. Each small plant can be operated in somewhat the same relationship to the other small plants as that which exists between product departments of a single diversified plant. This type of control over operations of a group of plants is characteristic of non-cooperative national dairy corporations. It offers a kind of competition which small cooperatively owned plants may have to meet to an increasing extent.

WHY SOME CO-OPS HAVE NOT KEPT UP WITH THE TREND

Reorganization of corporate structures and consolidation of resources, including plant facilities, offer the only means by which some cooperative dairy associations can get large-scale plants. Some associations

[19] Determining the minimum volume of milk necessary to profitably operate a diversified plant, as well as what constitutes a "reasonably diversified" plant, are problems that must be solved on an individual case basis or by limited local areas. Under peacetime conditions, a plant that is overly diversified may not be able to compete effectively with a specialized plant of comparative size.

[20] For example, the small creamery which received farm separated cream, and is dependent almost wholly on the price of butter, now has considerable competition outside the dairy industry and has some within. Outside the industry, fortified oleomargine is an established competitor; within the industry, the relative returns for other dairy products containing butterfat are always important.

which do not have large-scale plants could themselves bear the cost of construction of such plants and furnish the necessary volume of business. However, a sizable proportion of the total number of the associations in this country would be benefited by reorganization or by consolidation with one or more neighboring associations.

Many of the benefits to be derived from reorganization and consolidation of dairy cooperatives are not discussed herein. Those which pertain to a large volume of business and are most important have been outlined.

A statistical survey might be conducted to discover the reasons that have kept some associations from following the general trend in the industry toward large-scale plants. However, for purposes of this publication, such a survey does not seem necessary. The following reasons, would, in the opinion of the author, probably be found most important.

1. The directors and other members of some associations probably have been oblivious to even the existence of the trend toward large-scale plants. In a few cases, this might indicate a lack of ability to comprehend economic changes, but usually it would reflect only the shackles imposed on human activity and thought by the force of habit. Custom can be a real barrier to progress.

2. Directors and other members of some associations may have been aware of the trend but have not realized the economic benefits which might accrue to them from operating a large-scale plant.

3. The officers, directors, managers, and employees of some associations may have fought a change which would remove some of them from office and terminate the employment of others. Even an honest and conscientious cooperator may have his vision clouded by personal considerations.

4. Some large parent associations may have wished to refrain from promoting consolidation because of the resultant reduction in number of affiliated associations. They may also have feared that the remaining local associations would criticize such action and might even sever relations with them.

5. In some areas, particularly those supplying fluid milk to large urban centers, competition for the farm supply of fluid milk and cream may have been so keen that in order to be able to maintain a large volume of sales on the market some parent organizations have deliberately operated uneconomical local plants.

6. Individual and community loyalty to established local plants may have been so great in some localities that the economic advantages of consolidation have not been given proper consideration. Local business interests also may have wished to maintain the farmers' plants or organizations.

7. Personal convenience may have caused some producer-members to oppose change. Elimination of one or more local plants usually means that the milk from certain farms will have to be hauled a greater distance than formerly. The hauling costs of the farmers operating those farms might be increased, but net returns might also increase because the new plant would probably provide a better marketing outlet for their milk. However, the farmers might be more concerned with sure increases in costs than with possible increases in net returns. A great majority of the farmers affected by the consolidation would be benefited by it if it were economically sound.

8. Some producers probably have feared the creation of a monopoly through eliminating all but one or two plants or associations in a locality. Larger dairy plants result in, or are a result of, larger dairy organizations. Such organizations may contain elements of monopoly. However, the trend toward large-scale plants has already developed and it is merely a question of whether cooperative associations or non-cooperative organizations are to be dominant in each locality.

CONCLUSIONS

1. A trend toward large-scale plants has developed in the dairy industry.

2. A large volume of business permits economies which give a large-scale plant very definite competitive advantages over a small-scale plant. The large-scale plant is not necessarily more efficient but can be if factors other than size, such as management, are approximately equal.

3. A reasonably diversified large-scale plant appears best fitted, under certain conditions at least, to meet changing competitive conditions in the industry.

4. Local competitive conditions that have in the past permitted some associations to operate relatively inefficient plants may be changing. Due to improved facilities for transportation and communication, conditions 10 miles distant, 100 miles distant, and even 1,000 miles distant will be more important to each association than ever before.

5. Many plants in the major areas of dairy production will probably be eliminated during future years. The change can usually be effected much more cheaply and on a more economically sound basis if it occurs as the result of rationalized action rather than as a result of purely competitive processes.

6. If rationally planned action is not taken, competition may eliminate many plants at the expense of milk producers and their marketing system.

7. A dairy cooperative handicapped by possession of too small a plant can secure a large-scale plant by increasing the productive capacity of its existing plant, purchasing an established large plant, or by constructing a new large plant. The latter course of action will be desirable in many cases.

8. In order to operate a large-scale plant profitably, however, many an existing organization will have to either reorganize or consolidate with one or more neighboring associations.

9. No association should make a hurried or haphazard attempt at either reorganization or consolidation. Action should be taken only if a careful study of the situation has shown such action to be economically desirable. Then it must be decisive and comprehensive.

10. Planning for such action should be initiated as soon as possible because a "wait and see" policy may postpone reorganization or consolidation until it is too late to take effective action. A slogan heard during the early part of the last war - "Too little and too late" - may have special implications for some dairy cooperatives in the future.

BASIC STATISTICAL DATA

Table 5. - Creamery butter: Number of plants, total production, and average production per plant, United States, by years 1918-49[a]

YEAR	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT
		1,000 pounds	
1918	4,118	818,175	198.7
1919	3,742	868,125	232.0
1920	3,447	863,577	250.5
1921	3,463	1,054,938	304.6
1922	3,497	1,153,515	329.9
1923	3,539	1,252,214	353.8
1924	3,690	1,356,080	367.5
1925	3,715	1,361,526	366.5
1926	3,909	1,451,766	371.4
1927	3,887	1,496,495	385.0
1928	3,925	1,487,049	378.9
1929	4,141	1,597,027	385.7
1930	4,177	1,595,231	381.9
1931	4,397	1,667,452	379.2
1932	4,424	1,694,132	382.9
1933	4,515	1,762,688	390.4
1934	4,499	1,694,708	376.7
1935	4,488	1,632,380	363.7
1936	4,558	1,629,407	357.5
1937	4,660	1,623,971	348.5
1938	4,671	1,786,172	382.4
1939	4,646	1,781,737	383.5
1940	4,692	1,836,826	391.5
1941	4,619	1,872,183	405.3
1942	4,435	1,764,054	397.8
1943	4,334	1,673,788	386.2
1944	4,022	1,488,502	370.1
1945	3,763	1,363,717	362.4
1946	3,550	1,171,339	330.0
1947	3,415	1,329,094	389.2
1948	3,224	1,210,324	375.4
1949	3,140	1,412,101	449.7

[a]Data for years before 1931 are for creamery butter alone; from 1931 to 1949, inclusive, the data include the number and production of plants manufacturing whey butter.

Source of data: Compiled from reports of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 6. - American cheese: Number of plants, total production, and average production per plant, United States, by years 1918-49[a]

YEAR	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT
		1,000 pounds	
1918	2,485	253,634	102.1
1919	2,266	295,144	130.2
1920	1,826	254,684	139.5
1921	1,819	261,727	143.9
1922	1,808	282,806	156.4
1923	1,835	308,108	167.9
1924	1,936	324,695	167.7
1925	2,100	347,240	165.4
1926	2,120	335,915	158.5
1927	1,932	307,777	159.3
1928	2,010	335,253	166.8
1929	2,303	370,314	160.8
1930	2,297	378,816	164.9
1931	2,260	374,648	165.8
1932	2,274	370,743	163.0
1933	2,348	408,631	174.0
1934	2,339	435,491	186.2
1935	2,353	468,999	199.3
1936	2,370	487,576	205.7
1937	2,312	492,041	212.8
1938	2,358	560,542	237.7
1939	2,284	537,298	235.2
1940	2,300	602,790	262.1
1941	2,405	753,122	313.1
1942	2,464	916,850	372.1
1943	2,200	765,089	347.8
1944	2,144	804,787	375.4
1945	2,014	875,084	434.5
1946	1,835	801,264	436.7
1947	1,893	932,718	492.7
1948	1,750	854,447	488.3
1949	1,682	935,018	555.9

[a]Data pertain to production of American cheese made from whole milk; that made from part-skim or full-skim milk not included.

Source of data: Compiled from reports of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 7. - Dried skim milk: Number of plants, total production, and average production per plant, United States, by years 1918-42[1]

YEAR	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT
		1,000 pounds	
1918	57	26,202	459.7
1919	55	34,945	635.4
1920	56	41,893	748.1
1921	50	38,546	770.9
1922	53	40,617	766.4
1923	65	62,251	957.7
1924	72	69,219	961.4
1925	78	73,317	940.0
1926	99	91,718	926.4
1927	125	118,123	945.0
1928	175	147,996	845.7
1929	253	207,579	820.5
1930	317	260,675	822.3
1931	312	261,938	839.5
1932	313	270,194	863.2
1933	323	288,114	892.0
1934	330	294,935	893.7
1935	349	297,506	852.5
1936	394	349,550	887.2
1937	421	372,203	884.1
1938	442	449,291	1,015.5
1939	438	408,380	932.4
1940	451	481,805	1,068.3
1941	439	476,497	1,085.4
1942	492	626,562	1,273.5

[1]Production for both human food (nonfat dry milk solids) and animal feed included. Information on total number of plants producing dried skim milk is not available for years after 1942.

Source of data: Compiled from reports of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 8. - Nonfat dry milk solids: Number of plants, total production, and average production per plant, United States, by years 1935-49[1]

YEAR	ROLLER PROCESS			SPRAY PROCESS			TOTAL		
	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT	NUMBER OF PLANTS	TOTAL PRODUC-TION	AVERAGE PRODUC. PER PLANT
		1,000 pounds			*1,000 pounds*			*1,000 pounds*	
1935							189	187,531	9,992.2
1936							208	223,827	1,076.1
1937		Breakdown between roller and spray					240	244,511	1,018.8
1938							258	289,121	1,120.6
1939		processes not available for years					258	267,860	1,038.2
1940							273	321,843	1,178.9
1941		prior to 1943					307	366,455	1,193.7
1942							419	565,414	1,349.4
1943	347	264,024	760.9	134	245,596	1,832.8	448	509,620	1,137.5
1944	383	316,464	826.3	148	266,448	1,800.3	498	582,912	1,170.5
1945	379	344,932	910.1	167	297,614	1,782.1	498	642,546	1,290.3
1946	344	288,355	838.2	176	365,110	2,074.5	466	653,465	1,402.3
1947	315	259,237	823.0	183	418,704	2,288.0	453	677,941	1,496.6
1948	288	245,461	852.3	191	436,071	2,283.1	435	681,532	1,566.7
1949	291	304,321	1,045.8	209	629,341	3,011.2	458	933,662	2,038.6

[1]Comparable information not available for years prior to 1935.

Source of data: Compiled from reports of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 9. - Evaporated milk: Number of plants, total production, and average production per plant, United States, by years 1918-49[1]

YEAR	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT
		1,000 pounds	
1918	161	1,002,874	6,229.0
1919	156	1,194,496	7,657.0
1920	130	979,873	7,537.5
1921	136	1,028,172	7,560.1
1922	132	949,909	7,196.3
1923	139	1,252,520	9,010.9
1924	131	1,189,755	9,082.1
1925	125	1,202,456	9,619.6
1926	127	1,158,476	9,121.9
1927	129	1,273,815	9,874.5
1928	133	1,337,022	10,052.8
1929	148	1,499,644	10,132.7
1930	140	1,449,149	10,351.1
1931	134	1,428,993	10,664.1
1932	135	1,570,612	11,634.2
1933	137	1,716,700	12,530.7
1934	132	1,711,570	12,966.4
1935	137	1,838,890	13,422.6
1936	137	2,043,759	14,917.9
1937	145	1,902,545	13,121.0
1938	143	2,104,198	14,714.7
1939	143	2,170,601	15,179.0
1940	142	2,464,668	17,356.8
1941	147	3,246,547	22,085.4
1942	154	3,518,504	22,847.4
1943	146	3,057,274	20,940.2
1944	144	3,428,089	23,806.2
1945	145	3,776,383	26,044.0
1946	142	3,050,643	21,483.4
1947	135	3,208,027	23,763.2
1948	136	3,382,893	24,874.2
1949	132	2,755,780	20,877.1

[1]Unskimmed, unsweetened, case goods only.

Source of data: Compiled from reports of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 10. - Ice cream (wholesale): Number of plants, total production, and average production per plant, United States, by years 1938-49[1]

YEAR	NUMBER OF PLANTS	TOTAL PRODUCTION	AVERAGE PRODUCTION PER PLANT
		1,000 gallons	
1938	5,003	263,497	52.7
1939	4,202	278,532	66.3
1940	4,191	287,099	68.5
1941	3,979	340,992	85.7
1942	3,740	409,169	109.4
1943	3,594	368,938	102.7
1944	3,654	394,123	107.9
1945	3,699	424,289	114.7
1946	3,650	651,541	178.5
1947	3,768	576,979	153.1
1948	3,787	525,168	138.7
1949	3,308	506,803	153.2

[1]Production for wholesale distribution only; data do not include production of counter-freezers. Comparable information not available for years prior to 1938.

Source of data: Compiled from reports of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 11. - Cooperative cheese factories in Wisconsin: Number of plants in samples and percentages in indicated size groups based on annual production, 1926 and 1942[1]

ANNUAL PRODUCTION CHEESE	1926 (329 PLANTS)[2]	1942 (322 PLANTS)[3]
pounds	*percent*	
Under 100,000	20.1	6.8
100,000 - 199,999	50.2	32.6
200,000 - 299,999	22.5	28.3
300,000 - 399,999	5.1	14.9
400,000 - 499,999	0.9	7.2
500,000 - 599,999	0.0	4.7
600,000 - 699,999	0.3	1.2
700,000 - 799,999	0.3	0.9
800,000 - 899,999	0.0	0.3
900,000 - 999,999	0.0	0.6
1,000,000 and over	0.6	2.5
Total	100.0	100.0

[1]Includes all factories making cheese, not just specialized plants.

[2]Sample group of cooperative plants making cheese, selected with no distinctions as to variety made. Based on survey made by the Bureau of Agricultural Economics.

[3]Total number of cooperative plants making American cheese; production in those plants of other varieties of cheese was not included. Cooperative plants identified as such from Farm Credit Administration records; production figures compiled from records of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 12. - Creameries in Minnesota: Numbers of cooperative and non-cooperative plants in indicated size groups based on annual production, 1942[1]

ANNUAL PRODUCTION OF BUTTER	COOPERATIVE PLANTS	NON-COOPERATIVE PLANTS	ALL PLANTS
Pounds			
Under 100,000	36	52	88
100,000 - 199,999	119	61	180
200,000 - 299,999	136	43	179
300,000 - 399,999	105	15	120
400,000 - 499,999	79	21	100
500,000 - 599,999	53	6	59
600,000 - 699,999	25	2	27
700,000 - 799,999	13	3	16
800,000 - 899,999	11	1	12
900,000 - 999,999	8	2	10
1,000,000 and over	24	161	40
Total	609	222	831

[1]Includes all plants making creamery butter, not just specialized plants.

Source of data: Cooperative plants identified as such from Farm Credit Administration records; production figures were compiled from records of the Bureau of Agricultural Economics, United States Department of Agriculture.

Table 13 . - American-cheese factories in Wisconsin: Numbers of cooperative and non-cooperative plants in indicated size groups based on annual production, 1942[1]

ANNUAL PRODUCTION OF AMERICAN CHEESE	COOPERATIVE PLANTS	NON-COOPERATIVE PLANTS	ALL PLANTS
pounds			
Under 100,000	22	121	143
100,000 - 199,999	105	326	431
200,000 - 299,999	91	324	415
300,000 - 399,999	48	169	217
400,000 - 499,999	23	75	98
500,000 - 599,999	15	44	59
600,000 - 699,999	4	31	35
700,000 - 799,999	3	16	19
800,000 - 899,999	1	10	11
900,000 - 999,999	2	4	6
1,000,000 and over	8	20	28
Total	322	1,140	1,462

[1]Includes all factories making American cheese, not just specialized plants.

Source of data: Cooperative plants identified as such from Farm Credit Administration records; production figures were compiled from records of the Bureau of Agricultural Economics, U.S. Department of Agriculture.

Table 14. - Cooperative creameries in four Midwestern States: Average manufacturing costs per pound of butter, 173 plants grouped according to annual production of butter, 1949

ANNUAL PRODUCTION OF BUTTER	NUMBER OF PLANTS	RANGE OF COSTS PER POUND OF BUTTER	AVERAGE COST PER POUND OF BUTTER[1]
Pounds		*Cents*	
Less than 100,000	7	6.74 - 14.15	$ 8.78
100,000 - 199,999	29	3.83 - 9.62	6.82
200,000 - 299,999	34	3.75 - 9.47	5.95
300,000 - 399,999	29	3.71 - 8.24	5.71
400,000 - 499,999	32	3.36 - 7.10	5.36
500,000 - 599,999	15	3.62 - 6.06	4.79
600,000 - 699,999	4	3.24 - 6.06	4.28
700,000 - 799,999	5	3.05 - 5.60	4.55
800,000 - 899,999	7	2.54 - 6.11	4.62
900,000 - 999,999	2	4.57 - 4.92	4.75
1,000,000 and over	9	2.97 - 5.91	4.39
All Plants	173	2.54 - 14.15	5.73

[1]Sum of the items in each range divided by the number of plants.

Source: Cooperative Auditing Service, Inc., Minneapolis, Minnesota, *Cooperative Creameries, Summary of Comparative Costs of Operation, Periods ending May 1, 1949 to April 30, 1950.* 58 pp. *(Processed.)*